

## PROJECT SUMMARY

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The Hampton University Particle Physics group proposes to investigate the physics of multi-TeV collisions, and to mentor undergraduate and graduate students, most of whom will be African Americans.<sup>1</sup> The group was founded in 1997. It has joined the international ATLAS Collaboration, which will design, construct, operate, and study the data from, the ATLAS detector, a large general-purpose detector to be installed at the Large Hadron Collider (LHC) at CERN. Hampton University is a member of the U.S. ATLAS collaboration, a group of U.S. universities and national labs with responsibilities in the design and construction of ATLAS.

The LHC will be the premier particle physics facility in the world in the early decades of the 21st century. With a collision energy of 14 TeV, seven times higher than the current highest, it will open up to exploration an entirely new region of fundamental particle physics. Experiments conducted at the LHC will test the current Standard Model (SM) of electroweak interactions, and allow the exploration of strong-interaction phenomena in a new energy region. The LHC will provide opportunities for discovery for many years.

The Hampton group will help to construct the central (barrel) region of the Transition Radiation Tracker (TRT), consisting of 96 straw-tube modules with a total of 52,000 straws. The group will participate in installation of the detector in ATLAS (about 2002), in its operation (beginning about 2005), and in analysis of data.

Using new facilities at Hampton University, the group will prepare components and test completed modules. Components to be prepared include the drift tubes, drift-tube supports, sense wire supports, transition radiation material packs, and HV capacitor assemblies. These subassemblies will be sent to Duke and Indiana Universities for assembly into modules. Tooling and systems for production and quality control will be developed. (Funding for construction activities will also come from U.S. ATLAS and from instrumentation grants.)

The modules will be returned to Hampton for testing and wire-position surveys. To do this, an X-ray scanning test stand will be constructed; this activity includes the development of analog readout electronics, and a BridgeView-based data acquisition system. Also, a full-length prototype will be completed to develop the testing methods.

During the period covered by this proposal, the Hampton group will develop its interests in specific areas of physics with the ATLAS detector. A post-doctoral research associate stationed at CERN will continue to work on simulation of physics processes, as well as TRT construction.

The group will set up a mentoring program in which students get financial support by working on the project under faculty supervision, and meet with faculty for advising and tutoring. Graduate students will be brought into the project, beginning in 2001. Hampton also expects to become a QuarkNet Center. The group now hosts a member of the QuarkNet staff. QuarkNet is an educational effort of ATLAS, CMS and Fermilab, aimed at the high-school level.

Overall, the impact on science will be significant, through the development of state-of-the-art detector technology, and through new observations in an unexplored energy range. Participation in this forefront project will have great educational impact at Hampton University, an historically-Black university (HBCU). The mentoring and outreach programs will increase the number of members of under-represented groups entering careers in science.

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<sup>1</sup> The group's home page is at <http://www.cebaqf.gov/~mcfarlan/index.html>